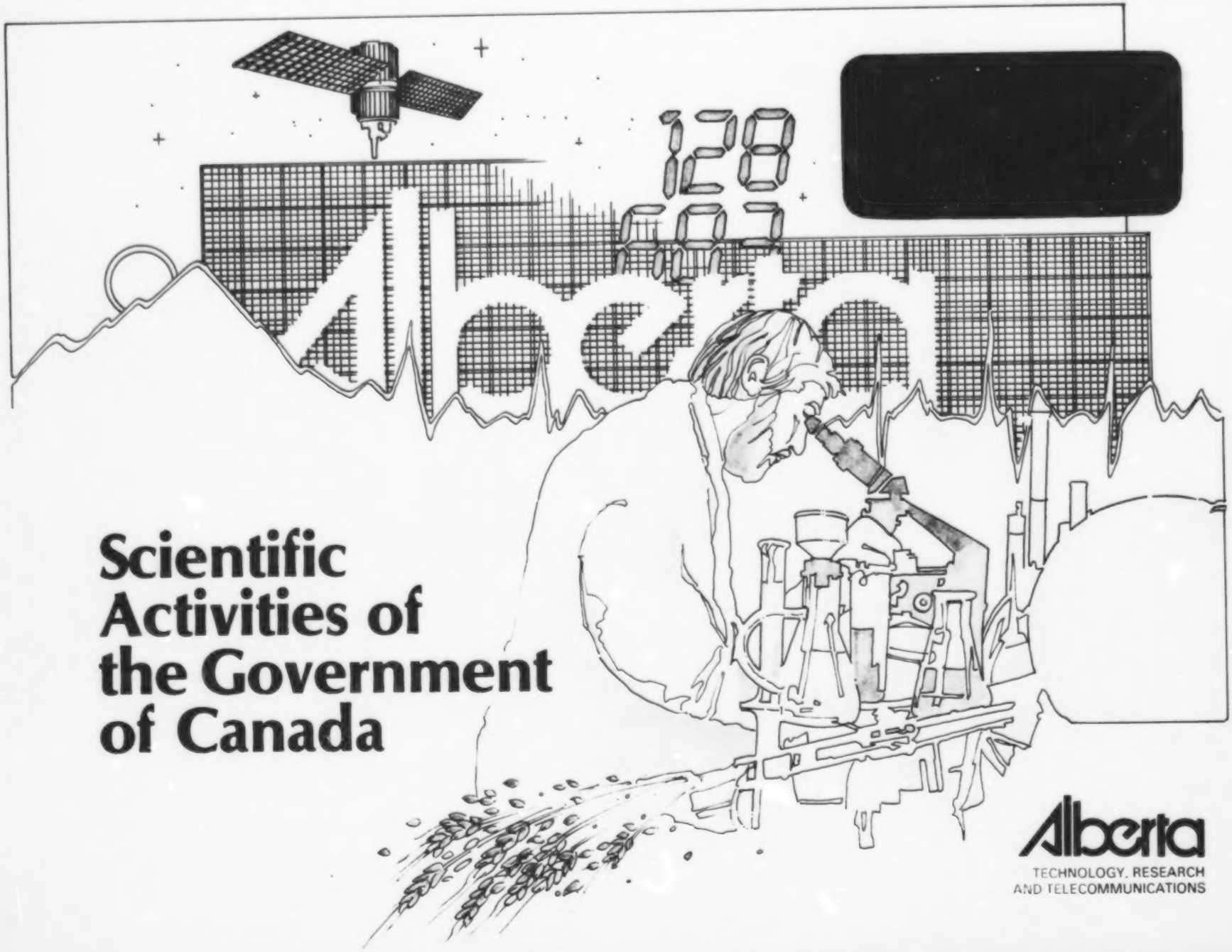

Scientific Activities of the Government of Canada

Alberta

TECHNOLOGY, RESEARCH
AND TELECOMMUNICATIONS

1986-87
OVERVIEW

I. INTRODUCTION

This publication is intended as a brief overview of the Government of Canada's resource commitment to scientific activities and the participation of Alberta organizations in the federal science agenda. All data is extracted from the annual survey of government departments and agencies conducted by Statistics Canada. On its own, this survey offers a series of indicators of federal government expenditures, the allocation to those expenditures, and priorities/ objectives in the scientific arena. These indicators can provide significant input to policy formulation and program evaluation when used in conjunction with the indicators generated from companion surveys, in particular those relating to the provincial government, the private sector, universities, and private nonprofit institutions.

The term "indicator" above is used deliberately. Specifically a number of problems exist with data relating to science activities, including: definitions, year-to-year consistency and measurement. Consequently, the reader should be alerted to an estimated confidence interval of ± 15 percent. It should also be noted that surveys involving different respondents (ie. funders vs performers) can yield substantially different results. While Technology, Research and Telecommunications (TRT) and Statistics Canada are working to resolve these limitations, and, while the data does offer reasonable order of magnitude estimates, caution is urged in drawing conclusions which exceed the rigor of the data.

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II. TOTAL EXPENDITURES — 1986/87

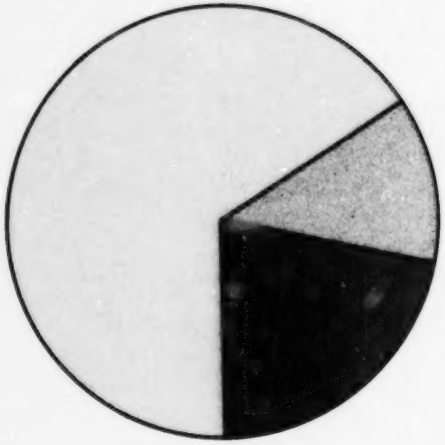
Total federal government expenditures on scientific activities increased to $4,181.2 million in 1986/87. Compared to expenditures of $2,737.3 million five years earlier, the 86/87 total represents an average annual growth rate of 8.8 percent. All performing sectors shared in the growth of science expenditures on a relatively even basis. Figure 1 illustrates the constancy of the performing sectors, their share of federally funded scientific activities has remained virtually unchanged over fiscal year 81/82 to fiscal year 86/87. Two-thirds of the federal science agenda is executed intramurally. Industry and universities perform about 30 percent of the federal science agenda.

As a reflection of the government's commitment to science, the expenditures of $4,181.2 million constitute roughly four percent of the year's total federal government expenditures. In fiscal year 81/82, science expenditures also constituted four percent of the total.

The federal pattern of science expenditures differs markedly from the Alberta Government's. During the five year period, the Province's spending on science grew on average 14.8 percent annually. Industries and universities emerged as the focal point of government science policy, performing 55 percent of publicly funded scientific activities. One quarter of the provincial science agenda was executed intramurally in fiscal year 86/87, down from one third in 81/82.

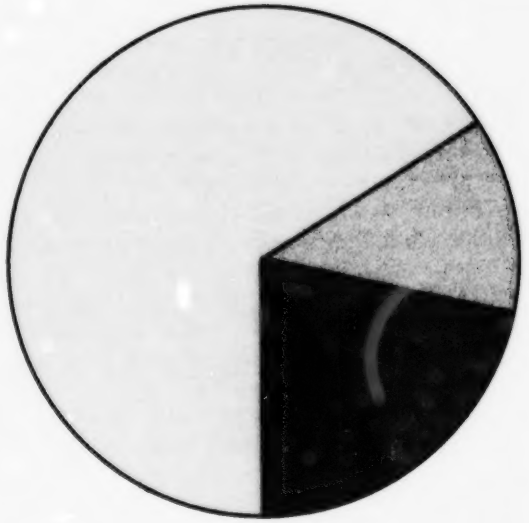
FIGURE 1

TOTAL EXPENDITURES IN NATURAL AND SOCIAL SCIENCES IN 86/87 AND 81/82



FISCAL YEAR 81/82
TOTAL: $2,737.3 MILLION

- Intramural: $1,804.7 million (66%)
- Industry: $369.3 million (13.5%)
- University: $387.1 million (14.1%)
- Other Canadian: $97.5 million (3.5%)
- Foreign: $78.6 million (2.8%)



FISCAL YEAR 86/87
TOTAL: $4,181.2 MILLION

- Intramural: $2,761.7 million (66%)
- Industry: $574.8 million (13.7%)
- University: $603.3 million (14.4%)
- Other Canadian: $105.7 million (2.5%)
- Foreign: $135.7 million (3.2%)

III. COMPOSITION OF EXPENDITURES

Natural sciences and engineering are the dominant science activities funded and performed by the federal government. Over the five year period, the natural sciences have been allocated a constant 80 percent of spending with social sciences allocated a constant 20 percent. In 86/87 this split resulted in natural sciences expenditures of $3,318.2 million and social sciences expenditures of $863 million.

The reliance on departments and government labs as performers of federal science activities is reflected in the intramural portion: 62 percent of all natural sciences activities and 81 percent of all social sciences activities were done in-house. Extramural performers, mainly industry and universities, garner about 38 cents of every federal government dollar allocated to natural sciences and engineering activities and about 19 cents of every dollar for social sciences activities.

A common practice in science and technology statistics is to differentiate between research and experimental development (R&D) and related scientific activities (RSA). The annual survey tracks the flow of federal funds to performers and the relative R&D and RSA undertaken by them. Table I depicts the 86/87 pattern of scientific activities.

Note the emphasis on natural sciences R&D which attracted over half (58%) of all current federal science dollars and 94 percent of current R&D expenditures. The federal government performed more R&D than it funded extramurally in the natural sciences in contrast to the social sciences. RSA is primarily an intramural activity; 81 percent of natural sciences RSA and 90 percent of social sciences RSA is performed by government establishments.

TABLE I

Current Expenditures in R&D and RSA by Performer, 1986/87 (excluding administration)

Activity	Intramural	Industry	Universities	Other Canadian	Foreign	Total
			($ in millions)			
R&D						
in-house	1068.5					1068.5
contracts	74.3	199.4	26.9	14.7	7.5	322.8
grants		277.4	481.9	43.0	90.1	892.4
fellowships	2.9	3.0	26.4	0.4	13.3	46.0
	1145.7	479.8	535.2	58.1	110.9	2329.7
RSA						
data collection	713.5	22.6	5.2	15.2	3.1	759.6
info services	277.3	2.6	5.2	9.4	5.9	300.4
testing and standards	46.6	3.1	0.2	0.8	0.8	51.5
feasibility studies	41.5	62.3	1.0	5.8	3.1	113.7
policy studies	80.4	2.5	0.5	5.4		88.8
education support	3.1	1.6	54.8	1.3	11.8	72.6
museum studies	82.3	0.2	0.8	9.7		93.0
	1244.7	94.9	67.7	47.6	24.7	1479.6
Total R&D and RSA	2390.4	574.7	602.9	105.7	135.6	3809.3
Natural Sciences R&D	1107.4	476.4	487.8	43.3	87.3	2202.2
Natural Sciences RSA	620.1	85.3	42.0	22.5	14.2	784.1

IV. NATURAL SCIENCES R&D

The federal government does not have a central science budget. Its R&D agenda is created by the various departments and agencies. Table II identifies the departments that shaped the science agenda through major expenditures on natural sciences R&D. Note that the primary products sector — agriculture, energy, and fisheries — constitutes about 30 percent of the federal R&D expenditures in the natural sciences. Indeed, agriculture had the highest annual growth rate, averaging 14 percent over 81/82 to 86/87. Energy, Mines and Resources also experienced an above average annual growth rate of 11.3 percent. Fisheries and Oceans was slightly below the average with 8.3 percent.

With the exception of Regional Industrial Expansion (RIE), Medical Research Council (MRC) and National Science and Engineering Research Council (NSERC), the departments in Table II are predominantly performers of R&D. Over 90 percent of Fisheries and Agriculture R&D spending is absorbed in-house. Defense performed 57 percent of the dollar value of its R&D, the lowest intramural allocation of these departments.

The leading funders of extramural R&D are RIE, National Research Council (NRC), MRC and NSERC. RIE expenditures account for 34 percent of all industry performed natural sciences R&D. In combination with NRC, over half (54%) of all industry performed R&D is accommodated. MRC and NSERC combined extramural expenditures fund 85 percent of university performed natural sciences R&D in Canada.

Departments that spent one-quarter to a third of their R&D budgets extramurally are Defense, Energy, Communications, and Transportation. Those spending less than one-quarter extramurally are Atomic Energy, Health and Welfare, Environment, Fisheries, and Agriculture.

TABLE II

Major Expenditures on Natural Sciences R&D by Department and by Performer, 1986/87

Department	R&D Spending	% of Total R&D	Performers			
			Intra	Industry	University	Other (not allocable)
	($ in millions)					
Agriculture	372.3	(15.0)	344.1		9.6	
Atomic Energy	150.8	(6.1)	130.6	17.4	0.4	
Communications	52.5	(2.5)	39.5	13.8		
Energy	263.7	(10.7)	187.5	40.4	5.9	
Environment	62.5	(2.5)	52.6	6.6	1.6	
Fisheries & Ocean	128.0	(5.2)	121.0	4.4		
Defense	220.0	(8.9)	126.4	80.5	7.4	
Health & Welfare	26.0	(1.0)	17.2		4.8	
Regional Industrial Expansion	186.2	(7.6)		161.9		
Councils:						
MRC	415.3	(16.9)	275.2	97.8	28.9	
NRC	161.5	(6.6)			151.4	
NSERC	281.7	(11.5)			263.3	
Others	125.8	(5.5)	67.3	68.0	14.5	
Totals*	2456.3*		1361.4	476.4	487.8	130.6

*varies from Table I due to including capital ($178.9 million) and administration ($75.1 million) expenditures associated with natural sciences R&D.

V. INTRAMURAL EXPENDITURES IN ALBERTA

The 86/87 dollar value of federal scientific activities in Alberta was $166 million of which $155 million was spent on the natural sciences and engineering. Sixty percent of the total expenditures, $101 million, were intramural expenditures. The activities of federal government science establishments in Alberta are summarized in Table III.

Agriculture Canada has the largest establishment in Alberta by value of science activity and manpower. The department's Alberta presence includes the Animal Disease Research Institute at Lethbridge, Western Labs at Calgary, Northern Forest Research Centre at Edmonton, an experimental farm at Vermilion, and research stations at Beaverlodge, Lacombe and Lethbridge. The department's activities in Alberta represent 12 percent of the total R&D performed intramurally under the Food Development program and about the same percentage of the Forestry program's R&D.

Environment Canada has several establishments in Edmonton: the Western Regional Atmospheric Environmental Service (AES), Western and Northern Canadian Wildlife Service, and an Environmental Protection Service installation. AES is the largest science program of the department and one that is primarily RSA. The Alberta group carried out four percent of the national program. Sixteen percent of the Conservation and Protection Program was performed in-house by the Alberta bureau.

The Suffield division of Defense is a research establishment principally for bio-chemical, medical defense systems. Defense personnel at Suffield executed 10 percent of the intramural research agenda.

Energy, Mines, and Resources (EMR) is represented by the Institute for Sedimentary & Petroleum Geology at Calgary and the CANMET Laboratory at the Coal Research Centre in Devon. The Institute is part of the Geologic Survey of Canada and is the centre of western and arctic Canada geological research. The Laboratory at Devon is the focus of CANMET's national coal beneficiation research. The Department's Minerals and Earth Sciences program spent about $230 million in intramural scientific activities. The Alberta establishments performed about nine percent of the dollar value of the program.

The social sciences intramural expenditures in Alberta are related primarily to Statistics Canada, $5.2 million out of $7 million. Under Environment's Conservation & Protection program, $1.2 million and 12 staff were allocated to RSA by Alberta installations.

TABLE III

1986/87 Intramural Science Expenditures of Federal Department Establishments in Alberta

Department: program	Total	R&D	Science Staff	R&D Staff
	($ in millions)			
Agriculture:				
forestry	7.0	5.8	93	83
food development	30.3	28.3	482	451
administration	.2		6	
	37.5	34.1	581	534
Energy, Mines & Resources:				
minerals & earth science	20.6	18.0	211	167
Environment:				
atmospheric environment service	9.2		230	
conservation & protection	14.5	2.1	201	32
	23.7	2.1	431	32
Defense:				
Services	13.0	13.0	183	183
Stats Canada	5.2		69	

VI. EXTRAMURAL EXPENDITURE IN ALBERTA

The extramural portion of federal expenditure on science constituted 33 percent on a national basis. Industry and universities were the main performers, accounting for about 80 percent of all extramural expenditures. As shown previously in Table I, the chief activity of these performers was natural sciences R&D. These characteristics hold true for the extramural federal expenditures in Alberta.

In the national context, industry and university performers of R&D and RSA tend to be markedly concentrated in Ontario and Quebec. Of grants to industry totalling $540 million, 78 percent were awarded to firms located in those two provinces as shown in Figure 2. With respect to the $584 million in grants or contracts to universities, about 64 percent were awarded to Ontario and Quebec institutions. Note that the flow of funds to universities shows a different distribution from awards to industry, indicating independent allocation criteria among funders.

The departments that are major funders of extramural R&D and the dollar value of awards to Alberta organizations are shown in Table IV. Awards to Albertans constitute 5.3 percent of the 86/87 total. The Alberta proportion of extramural spending has been in the order of five percent since 82/83. There appears to have been a significant decrease in extramural natural sciences performed in Alberta after 1981/82. In that year, Alberta organizations performed nine percent of the federally funded natural sciences agenda, a dollar value of $60 million out of $664 million.

The bulk of the 86/87 expenditures were contracts or grants to industry and the universities for natural sciences R&D valued at $54 million. As depicted in Table IV, the MRC and NSERC are the main sources of federal funding. All of MRC and almost all of NSERC grants flow to universities. The Universities of Alberta and Calgary secured grants amounting to $38 million from the two granting councils. This represents 8.6 percent of MRC and 9.6 percent of NSERC research grant monies. In contrast, note that Alberta universities secured about three percent of research grants available under the Social Sciences and Humanities Research Council (SSHRC).

The dollar value of natural science R&D performed by Alberta industry is in the order of $14 million which represents 2.3 percent of the national awards to industry. Table V presents a description of the source and type of funds flowing to local firms. Note that the largest pool of R&D grant monies to industry is RIE. Industry in Alberta secured only 1.6 percent of these federal funds. In contrast, Quebec firms garnered 58 percent, valued at $117 million. When combined with the value of grants to Ontario firms, ($52 million) and the National Capital Region ($4.5 million), 85 percent of RIE grant monies were absorbed by Upper and Lower Canada. This is consistent with the marked concentration of federally funded industrial natural sciences activity depicted in Figure 2.

The decrease in federal extramural expenditures in Alberta between 81/82 and 82/83 appears to have largely effected industry. The flow of extramural funds to the universities via the granting councils has remained stable over 81/82 to 86/87. Similarly, federal intramural expenditures in Alberta have remained stable over the period. This suggests that the decrease in extramural expenditures from nine percent to 5.3 percent was not occasioned by a shift of funding from extramural to intramural Alberta performers. Nor did it reflect a decline in university grants. An exploration of this change in industry success in securing federal grants and contracts is being researched by TRT.

FIGURE 2

INDUSTRY AND UNIVERSITY PERFORMERS OF FEDERALLY FUNDED SCIENCE ACTIVITIES BY PROVINCE AS A PERCENTAGE, 1986/87

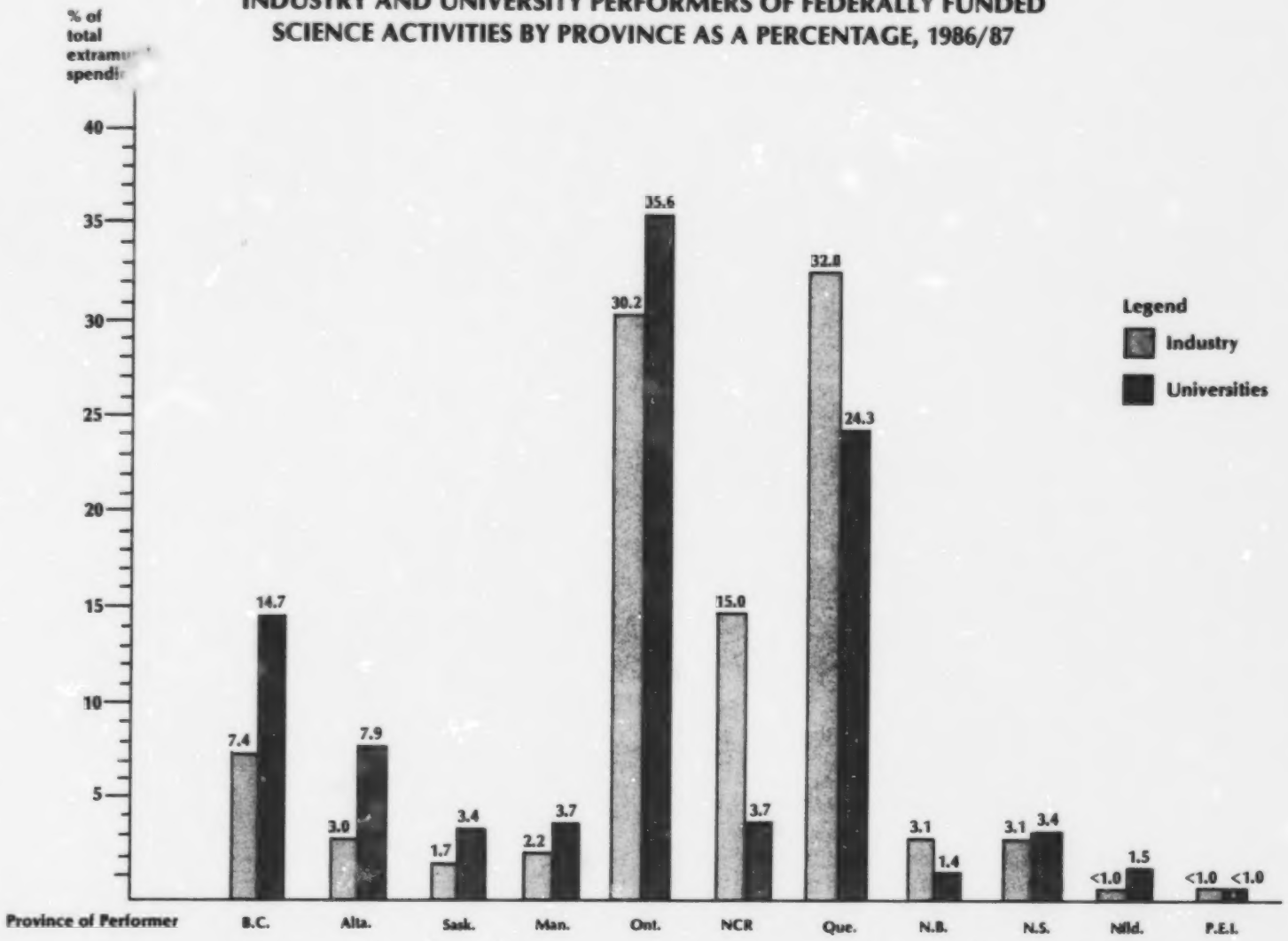


TABLE IV

Major Funders of Extramural R&D and Dollar Value of Alberta Performers, 1986/87

Department	R&D Expenditures	Alberta Performers
	($ in millions)	
EMR	61	2
Defense	88	3
RIE	207	3
NRC	129	5
MRC	152	13
NSERC	266	25
SSHRC	32	1
Other	137	5
Total	1072	57

TABLE V

Federally Funded Natural Sciences R&D Performed by Alberta Industry, 1986/87

Source	Alberta	Total
	($ in millions)	
Grants		
RIE	3.3	202.3
NRC	3.4	65.0
Other	0.2	48.1
Sub-total	6.9	315.4
Contracts		
Defense	2.4	76.6
Supply & Services	0.6	13.3
NRC	0	23.6
Other	4.1	61.1
Sub-total	7.1	174.6
Total	14.0	490.0

VII. COMPARISON OF GOVERNMENTS

The Federal and Provincial governments offer distinctive approaches to science. The federal government is essentially a performer of R&D and RSA while Alberta is essentially a funder of R&D and a performer of RSA. Two-thirds of the provincial government's R&D agenda is executed by industry and universities; federally, two-thirds is performed in-house. Provincial expenditures emphasize energy (petroleum) and medical R&D over the five year period. The federal spending emphasizes agriculture and energy (mining).

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